

Research Article

Large-Capacity Magazines and the Casualty Counts in Mass Shootings: The Plausibility of Linkages

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Abstract

Do bans on large-capacity magazines (LCMs) for semiautomatic firearms have significant potential for reducing the number of deaths and injuries in mass shootings? The most common rationale for an effect of LCM use is that they allow mass killers to fire many rounds without reloading. LCMs are known to have been used in less than one third of 1% of mass shootings. News accounts of 23 shootings in which more than six people were killed or wounded and LCMs were known to have been used, occurring in the United States in 1994–2013, were examined. There was only one incident in which the shooter may have been stopped by bystander intervention when he tried to reload. In all of these 23 incidents, the shooter possessed either multiple guns or multiple magazines, meaning that the shooter, even if denied LCMs, could have continued firing without significant interruption by either switching loaded guns or changing smaller loaded magazines with only a 2- to 4-seconds delay for each magazine change. Finally, the data indicate that mass shooters maintain such slow rates of fire that the time needed to reload would not increase the time between shots and thus the time available for prospective victims to escape.

Keywords

mass shootings, gun control, large-capacity magazines

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Introduction—Mass Shootings and Large-Capacity Magazines (LCMs)

There have been at least 23 shootings in which more than six victims were shot and one or more LCMs were known to have been used in the United States in the period 1994–2013. One of the most common political responses to mass shootings has been to propose new gun control measures, commonly focusing on “assault weapons” and LCMs. LCMs are detachable ammunition magazines used in semiautomatic firearms that are capable of holding more than a specified number (most commonly 10 or 15) rounds. For example, the 1994 federal assault weapons ban prohibited both (a) certain kinds of guns defined as assault weapons and (b) magazines able to hold more than 10 rounds (Koper, 2004). At least eight states and the District of Columbia similarly ban magazines with a large capacity, and still other states are considering bills to enact such restrictions (Brady Campaign to Prevent Gun Violence, 2013).

Theory—The Rationale for LCM Bans

When supporters of bans on LCMs provide an explicit rationale for these measures, they stress the potential for such restrictions to reduce the death toll in mass shootings. And indeed there is a statistical association between LCM use and the casualty count in mass shootings (Koper, 2004), though it is unknown whether this reflects an effect of LCM use or is merely a spurious association reflecting the offender’s stronger intention to harm many people. If there is a causal effect, how would it operate? Does possession of LCMs somehow enable aggressors to shoot more victims, above and beyond the ability conferred by the use of semiautomatic guns equipped with smaller capacity detachable magazines? (A semiautomatic firearm is a gun that fires a single shot for each pull of the gun’s trigger, but automatically causes a fresh round to be loaded into the gun’s firing chamber.)

Possession of LCMs is largely irrelevant to ordinary gun crimes, that is, those with fewer victims than mass shootings, because it is extremely rare that the offenders in such attacks fire more rounds than can be fired from guns with ordinary ammunition capacities. For example, only 2.5% of handgun crimes in Jersey City, NJ, in 1992–1996 involved over 10 rounds being fired (Reedy & Koper, 2003, p. 154). Even among those crimes in which semiautomatic pistols were used, and some of the shooters were therefore likely to possess magazines holding more than 10 rounds, only 3.6% of the incidents involved over 10 rounds fired. Thus, if LCMs have any effect on the outcomes of violent crimes, it is more likely to be found among mass shootings with many victims, which involve unusually large numbers of rounds being fired.

Koper (2004) noted that “one of the primary considerations motivating passage of the ban on [LCMs]” was the belief that

semiautomatic weapons with LCMs enable offenders to fire high numbers of shots rapidly, thereby potentially increasing both the number of persons wounded per gunfire incident . . . and the number of gunshot victims suffering multiple wounds, both of which would increase deaths and injuries from gun violence. (p. 80)

This summary was as much a rationale for restricting semiautomatic guns as it was for limits on magazine capacity, but Koper also concluded that “an LCM is arguably the most important feature of an AW. Hence, use of guns with LCMs is probably more consequential than use of guns with other military-style features” (p. 80). He then went on: “By forcing AW and LCM offenders to substitute non-AWs with small magazines, the ban might reduce the number of shots fired per gun, thereby reducing both victims shot per gunfire incident and gunshot victims sustaining multiple wounds” (p. 81).

It is reasonable to expect fewer people shot if fewer rounds were fired, but Koper did not explain why, for example, the use of three 10-round magazines would result in fewer shots fired than if a 30-round magazine were used. After all, three 10-round magazines and one 30-round magazine both contain 30 cartridges and thus allow 30 shots to be fired. Semiautomatic guns do not fire any faster when they have a larger magazine inserted in them than when they have a smaller magazine, nor is the lethality of any one shot affected by the size of the magazine from which it came. A limit on the number of cartridges that the shooter could fit into any *one* magazine would not limit the total number of rounds of ammunition that a would-be mass shooter could bring to the scene of their crime, or even the total number loaded into multiple detachable magazines.

The main difference between a 30-round magazine and three 10-round magazines, however, is that a shooter equipped with three 10-round magazines would have to change magazines twice in order to fire 30 rounds, while a shooter with a 30-round magazine would not have to change magazines at all. This presumably is what Koper (2004) meant when he wrote that “semiautomatic weapons with LCMs enable offenders to fire high numbers of shots rapidly” (p. 80).

Thus, it could be the *additional magazine changes* necessitated by the use of smaller magazines that might reduce the number of people hurt in mass shootings. Advocates of LCM bans argue that, if LCMs were not available, would-be mass murderers would shoot fewer people because they *would have to reload more often* due to the more limited capacities of the magazines that would then be legally available. A spokesperson for the Violence Policy Center (2011), for example, argued that “High-capacity ammunition magazines facilitate mass shootings by giving attackers the ability to fire numerous rounds without reloading.”

It is not, however, self-evident why this should be so. Skilled shooters can change detachable magazines in 2 seconds or less, and even relatively unskilled persons can, with minimal practice, do so in 4 seconds (for a demonstration, see the video at <https://www.youtube.com/watch?v=ZRCjY-GtROY>, which shows a 2-seconds magazine change by an experienced shooter). Certainly, additional magazine changes do not increase the time needed to fire a given number of rounds by much.

Why, then, might inducing more magazine changes reduce casualty counts? Two explanations have been offered. First, during an additional interval when the shooter was forced to change magazines, *bystanders might tackle the shooter and prevent any further shooting*. Bystanders are presumably more willing to tackle a shooter while the shooter was reloading because it would be safer to do so—a shooter armed with only

one loaded gun would not be able to shoot those seeking to intervene during the effort to reload. A shooter equipped only with smaller capacity magazines would have to change magazines sooner and would therefore presumably shoot fewer people before he was tackled by the bystanders.

Second, additional magazine changes could extend the time interval between some of the shots, thereby *allowing more prospective victims to safely escape the scene* than otherwise would have been the case had the possession of LCMs enabled the shooter to reload less often.

These scenarios are plausible as logical possibilities, but have they actually occurred in the past often enough for it to be plausible that they would happen with some nonnegligible frequency in the future? If the past is any guide to the future, the credibility of any expectation of future benefits from LCM restrictions would rely heavily on how often these scenarios have actually played out in past mass shootings. This research is intended to test the plausibility of these possible causal linkages between LCM use and the casualty counts of mass shootings by closely examining the relevant details of such crimes. In particular, it was intended to estimate the share of mass shootings in which LCM use could plausibly have affected the casualty count.

Prior Research on LCMs

No one has actually tested whether mass shooters with LCMs fire more rounds than those without LCMs. We only have evidence indirectly bearing on this issue. Koper reported data showing that there are more *gunshot wound victims* in incidents in which the offender used an LCM (Koper, 2004, p. 86). The meaning of this statistical association, however, is unclear since one would expect it to exist even if LCM use had no causal effect on either the number of shots fired or the number of victims shot. The association is at least partly spurious if the deadliness of the shooter's intentions affects both his selection of weaponry (including magazines) and the number of shots he fires or persons he wounds.

It is a virtual tautology that the deadliness of the shooter's intentions affects the number of people hurt, unless one is prepared to assert that there is no relationship whatsoever between violent intentions and outcomes. While it is certainly true that outcomes do not match intentions perfectly, it is unlikely that there is no correlation at all.

The deadliness of a would-be mass shooter's intentions, however, is also likely to affect preparations for the shooting, such as accumulating many rounds of ammunition, acquiring multiple guns and multiple magazines, and selecting larger magazines rather than smaller ones. Accounts of mass shootings with high death tolls routinely describe the shooters making elaborate plans for their crimes, well in advance of the attacks, and stockpiling weaponry and ammunition (e.g., see Office of the State's Attorney 2013, regarding the Sandy Creek elementary school shootings; *Washington Post* "Pa. Killer had Prepared for 'Long Siege,'" October 4, 2006, regarding the Amish school killings in Lancaster, PA; Virginia Tech Review Panel, 2007, especially pp. 25–26, regarding the shootings at Virginia Tech; "Before gunfire, hints of bad

news,” *New York Times* August 27, 2012, regarding the Aurora Colorado movie theater shootings). In short, people who intend to shoot many people are not only more likely to end up doing so but also prepare for doing so by acquiring equipment that they believe is better suited to this task.

The most direct indication that the intentions of mass shooters are more deadly than those of the average gun aggressor, aside from the number of casualties inflicted itself, is the percentage of wounded victims who were killed rather than nonfatally wounded. The data gathered for the present study indicate that in 23 LCM-involved mass shooting incidents, a total of 197 gunshot victims were killed and 298 were nonfatally wounded, for a fatality rate of 40.0%. In contrast, Cook (1985, p. 96) reported that police reports on general samples of shootings indicated that about only 15% of those wounded by gunshot were killed. Thus, the lethality of gunshot wounds inflicted by mass shooters is about 2.7 times as high as for shootings in general. Any one shot fired from a gun equipped with a larger capacity magazine is no more deadly or accurate than one fired from a gun with a smaller capacity magazine, so it is implausible that LCMs affect this fatality rate (deaths/persons wounded) by enabling shooters to more accurately hit vital areas of a victim’s body where wounds are more likely to be fatal. Indeed, if those who suggest that shooters with LCMs fire faster than other shooters are correct, accuracy would be worse in LCM-involved shootings.

Thus, it is more likely that the high fatality rate in mass shootings is a product of the aggressor’s stronger intentions to shoot more people, though it could also be partly a product of the greater use of rifles and shotguns in mass shootings (25 of the 66 guns used in these incidents [38%] of known gun type were rifles or shotguns; in comparison, only 8% of all U.S. gun homicides in 2014 were committed with rifles or shotguns—U.S. Federal Bureau of Investigation [FBI], 2015). This too could be an indication of greater shooter lethality, since rifles and shotguns are, on average, more lethal than handguns (Kleck, 1984). In sum, mass shooters appear to have more lethal intentions as aggressors, apart from any advantages they may gain from use of LCMs.

There is therefore sound reason to question whether a simple bivariate association between LCM use and number of shots fired, or victims wounded, in a mass shooting reflects a causal effect of LCM use. Unfortunately, there is no known way to directly measure the lethality of shooters’ intentions at the time of their shootings, so we cannot simply statistically control for lethality of intentions in order to isolate the effect of LCM use. On the other hand, it would become more plausible to conclude that LCM use made its own contribution to the casualty count of shootings, above and beyond the effects of the apparently more lethal intentions of their users, if there was some evidence that either (a) significant numbers of mass shootings were disrupted by bystanders intervening when the shooters attempted to reload detachable magazines or (b) magazine changes increase the time intervals between shots fired, thus potentially allowing more prospective victims to escape to safety. This article provides a close examination of the details of mass shootings so as to cast light on these and related issues.

Method

Definition of Eligible Incidents

We tried to identify, as comprehensively as possible, all mass shootings that occurred in the United States in the 20-year period from 1994 through 2013 inclusive and that were known to have involved an LCM. An LCM was defined as a magazine holding more than 10 rounds of ammunition. A mass shooting was defined as one in which more than six people were shot, either fatally or nonfatally, in a single incident. Any specific numerical cutoff is necessarily somewhat arbitrary, but some are less arbitrary than others. The six-victim cutoff was used because an offender could shoot as many as six persons using a typical old-fashioned six-shot revolver of the sort that has been around since the 19th century, and our goal was to identify all incidents in which it was plausible that use of an LCM (always used in connection with modern semiautomatic firearms) affected the number of casualties. It is less likely that LCMs affect the casualty count in incidents in which few people were shot, and generally fewer rounds were fired, since the rationale for banning LCMs is that they permit shooters to fire many rounds without reloading, and thereby kill or injure more victims (Koper, 2004). Thus, had the numerical cutoff been set lower, the sample of incidents would have included more cases in which LCM use was unlikely to have affected the number of victims. In that way, we have intentionally biased the sample in favor of the hypothesis that LCM use causes a higher casualty count.

We partly relied on a list compiled by the staff of the Violence Policy Center (2015) to identify LCM-involved mass shootings. Because this organization advocates bans on LCMs (Violence Policy Center, 2011), we are confident its staff were well motivated to compile as comprehensive a list as possible so as to better document the need to restrict magazine capacities. Our search of NewsBank and the other compilations of mass shootings that we cite (see Data Sources section) did not uncover any additional qualifying incidents. It is nevertheless logically impossible to know for certain that all qualifying incidents were included.

We did not employ the oft-used definition of “mass murder” as a homicide in which four or more victims were killed, because most of these involve just four to six victims (Duwe, 2007), which could therefore have involved as few as six rounds fired, a number that shooters using even ordinary revolvers are capable of firing without reloading. LCMs obviously cannot help shooters who fire no more rounds than could be fired without LCMs, so the inclusion of “nonaffectable” cases with only four to six victims would dilute the sample, reducing the percentage of sample incidents in which an LCM might have affected the number of casualties. Further, had we studied only homicides with four or more dead victims, drawn from the FBI’s Supplementary Homicide Reports (SHR), we would have missed cases in which huge numbers of people were shot, and huge numbers of rounds were fired, but three or fewer of the victims died. For example, in one widely publicized shooting carried out in Los Angeles on February 28, 1997, two bank robbers shot a total of 18 people—surely a mass shooting by any reasonable standard (Table 1). Yet, because none of the people they shot died, this incident would not qualify as a mass murder (or even murder of

Table I. Mass Shootings in Which Shooter(s) Used Magazines With a Capacity Over 10 Rounds, United States, 1994–2013.^a

Shooter(s)	Date	Number of Shooters	Number of Guns	Number of Magazines	Capacity of Largest Magazine	Shooter(s) Reloaded?	Number of Shots Fired	Seconds Per Shot	Number Killed	Number Nonfatally Wounded
Dean Allen Mellberg Larry Phillips, Jr., and Emil Matasareanu	June 20, 1994 February 28, 1997	1 2	2 6	4 9+	70 100	?	43–56	<6	4	23
Mitchell Johnson and Andrew Golden	March 24, 1998	2	13	3	30	?	30	?	5	11
Kip Kinkel	May 21, 1998	1	3	3+	50	Yes	51	?	2	15
Dylan Klebold and Eric Harris	April 20, 1999	2	4	16	52	Yes	188	15.64	13	21
Larry Gene Ashbrook	September 15, 1999	1	2	6	15	Yes	>100	6.00	7	7
Byran Koji Uyesugi	November 2, 1999	1	3	15	15	?	10	180.0	7	0
Michael McDermott	December 26, 2000	3	4+	30	30	Yes	37	10.54	7	0
Terry Ratzmann	March 12, 2005	1	3	15?	15?	Yes	22	<2.7	7	4
Seung-Hui Cho	April 16, 2007	2	19	15	15	Yes	174	53.79	32	23
Robert Hawkins	December 5, 2007	1	2	30	30	?	>30	12.00	8	5
Steven Kazmierczak	February 14, 2008	4	6+	33	Yes	56	5.36	5	21	
Jiverley Wong	April 3, 2009	2	3	30	Yes	99	?	13	4	
George Sodini	August 4, 2009	4	3+	30	?	50	?	3	9	
Nidal Hasan	November 5, 2009	2	15	30	Yes	214	?	13	38	
Timothy Hendron	January 7, 2010	4	3+	Probable LCM	?	115	c. 18	3	5	
Omar Thornton	August 3, 2010	2	4	17	?	19	9.47	8	2	
Jared Loughner	January 8, 2011	1	4	33	No ^b	31	0.45	6	13	
Eduardo Sancion	September 6, 2011	3	3	30	Yes	60+	1.42	4	14	
James Holmes	July 20, 2012	4	4	100	Yes	76	4.74	12	58	
Michael Page	August 5, 2012	1	3	19	Yes	33+	?	6	3	
Andrew Engeldinger	September 27, 2012	1	2	15	Yes	46+	16.3	6	2	
Adam Lanza	December 14, 2012	4	12+	30	Yes	154+	1.56	26	2	

Note. Details of these incidents and citations to news accounts used as sources may be found in the appendix to an extended version of this article, with the same title, on the Social Science Research Network, at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2700166. LCM = large-capacity magazine; c = circa, i.e. approximately; ? = unknown.
^aNumber of guns is the number in the shooter's immediate possession, not necessarily the number fired. Number of magazines is the number of detachable magazines in the shooter's immediate possession. The number includes magazines in loaded semiautomatic firearms. "Seconds per shot" is the average time interval between shots through the period of shooting. ^bShooter was prevented from reloading a defective magazine by bystanders tackling him.

any kind). Exclusion of such incidents would bias the sample against the proposition that LCM use increases the number of victims by excluding incidents with large numbers of victims.

We also excluded shootings in which more than six persons were shot over the entire course of the incident, but the shootings occurred in multiple locations with no more than six people shot in any one of the locations, and substantial periods of time intervened between episodes of shooting. An example is the series of killings committed by Rodrick Dantzler on July 7, 2011. He killed seven people and wounded two others, but did so in three different locations over a 5-hr period, shooting no more than four people in any one of the locations. Since shooters in these types of incidents have ample time to reload between sets of shots even without LCMs, use of an LCM is less likely to be relevant to the casualty counts than in a mass shooting as defined herein.

It is not possible to compare shootings involving LCMs with shootings not involving LCMs, because no source of information on shooting incidents, whether news media reports or police offense reports, systematically establishes which shootings did *not* involve LCMs. Thus, it is impossible to distinguish (a) shootings in which the perpetrator did not use an LCM from (b) shootings in which the perpetrator *did* use an LCM, but this fact was not mentioned in the account of the incident. Consequently, we are necessarily limited to describing incidents that were affirmatively identified as involving LCMs. In any case, since our purpose was to establish how often LCM use affects casualty counts in mass shootings, even if we could identify incidents that definitely did not involve LCMs, they would be irrelevant to this narrow purpose because they are obviously cases in which LCM use could not have affected casualty counts.

Data Sources

We relied on news stories to identify mass shootings and get information on their details. Relying on news outlets has obvious limits, since some mass shootings get little news coverage beyond a few stories by news outlets near the shooting location, and it is possible that none of the writers of these few stories used even one of the common words and phrases we used in our database searches. Further, even multiple news accounts of widely reported incidents may not include crucial details of the incidents, especially the number of shots fired and the duration of the shooting. Also, early news accounts of shootings are sometimes inaccurate in their details (Huff-Corzone, Corzone, Jarvis, Tetzlaff-Bemiller, Weller, & Landon, 2014), so we consulted later stories on a given incident (often pertaining to the trial of the shooter) in addition to early ones. Excluding the early news stories, we found that reported details of mass shootings were extremely consistent across stories. Fortunately, the known biases of news coverage of crime mostly work in favor of our goal of covering shootings in which many shots were fired, since news coverage is biased in favor of reporting incidents with larger numbers of victims (Duwe, 2000).

The alternative of using police reports was not feasible because such reports are not publicly available for a large share of homicides. Relying on the FBI's SHR would be

even worse than news accounts for our purposes, because this source says nothing about the number of rounds fired, number of guns used, details about the guns used (beyond whether they were handguns, rifles, or shotguns), number of magazines used, or the capacity of magazines used for *any* homicide incidents, whereas news stories provide such information for many mass shootings. These same deficiencies apply to data from the FBI's National Incident-based Reporting System, which have the additional disadvantage of covering only part of the nation.

A variety of sources were used to identify eligible incidents. First, as previously noted, we consulted "Mass Shootings in the United States Involving High-Capacity Ammunition Magazines," a fact sheet compiled by the Violence Policy Center, available online at http://www.vpc.org/fact_sht/VPCshootinglist.pdf. This source only covers incidents known to involve magazines with a capacity of 10 or more rounds.

Second, we searched the NewsBank Infoweb online database which covers hundreds of print, broadcast, and online news outlets, including newspapers, news magazines, transcripts of television news programs, and online-only news providers, in every state in the nation. We searched for articles whose text (including headlines) included any of the following phrases: "mass shooting," "massacre," mass murder, "shooting spree," or "rampage" for the 20-year period from January 1, 1994, through December 31, 2013.

Third, we consulted the following existing compilations of mass shootings, mass murders, and "active shooter incidents" (and the sources they cited) to identify potentially relevant shooting incidents:

- "US Mass Shootings, 1982–2012: Data from Mother Jones' (2013) Investigation," created by the staff of *Mother Jones* magazine, available online at <http://www.motherjones.com/politics/2012/12/mass-shootings-mother-jones-full-data>. This source only covers incidents in public places with four or more dead, and therefore misses those with many victims shot but three or fewer of them fatally as well as incidents occurring in private places. It also includes some spree shootings in which only a few victims were shot in any one location.
- "Analysis of Recent Mass Shootings" (September 2013), compiled by Mayors Against Illegal Guns, and available online at <http://www.demandaction.org/detail/2013-09-updated-analysis-of-recent-mass-shootings>. This covers incidents only for January 2009 to September 2013, and only those with four or more dead victims, thereby excluding those with many victims shot, but three or fewer shot fatally.
- Bjelopera, Bagalman, Caldwell, Finklea, and McCallion (March 18, 2013). *Public Mass Shootings in the United States: Selected Implications for Federal Public Health and Safety Policy*. Washington, DC: Congressional Research Service. This source only covers incidents occurring in public places and with four or more deaths, thereby excluding cases with many victims shot but three or fewer fatally as well as those occurring in private places.
- Citizens Crime Commission of New York City. "Mass Shooting Incidents in America (1984–2012)," at <http://www.nycrimecommission.org/mass-shoot>

ing-incidents-america.php, accessed January 15, 2014. This source covers shootings with four or more persons killed, with a magazine capable of holding more than 10 rounds. It excludes cases with no known use of LCMs, and incidents with many victims shot but three or fewer killed.

Notwithstanding the use of these multiple sources, we cannot be certain of achieving absolutely complete coverage of all LCM-involved mass shootings. Most of the sources rely, directly or indirectly, on news media accounts of the incidents, and some of these shootings received little coverage beyond local news outlets and perhaps an Associated Press state wire service story. The fewer news stories reporting an incident, the more likely it is that there were no stories containing any of the commonly used phrases for which we searched. The mass shootings most likely to receive little news coverage are those with fewer than four victims killed. Most of the lightly covered incidents we discovered also involved fewer than 10 victims shot, fatally or nonfatally.

On the other hand, it is unlikely that we missed many large-scale shootings, because these are likely to be well covered by multiple news outlets. Since those we missed are likely to involve fewer victims, it is also less likely that an LCM was needed for shooting as many people as were shot in these incidents. Omission of these cases, therefore, biases the sample in favor of the hypothesis that LCMs affect casualty counts.

As a check on the completeness of coverage of our methods, we used the FBI's SHR data to identify all SHR-covered U.S. homicides that involved more than six dead victims and the use of firearms (not just those involving LCMs). These SHR data sets cover about 90% of U.S. homicides. For the period 1994–2013, we identified 17 qualifying incidents in the SHR data sets. We then checked to see if our search methods would have identified these cases. We found that searches of the NewsBank database alone identified all 17 of these incidents. Thus, shootings with many dead victims clearly are completely covered by the news media.

Once eligible incidents were identified, we searched through news accounts for details related to whether the use of LCMs could have influenced the casualty counts. Specifically, we searched for (1) the number of magazines in the shooter's immediate possession, (2) the capacity of the largest magazine, (3) the number of guns in the shooter's immediate possession during the incident, (4) the types of guns possessed, (5) whether the shooter reloaded during the incident, (6) the number of rounds fired, (7) the duration of the shooting from the first shot fired to the last, and (8) whether anyone intervened to stop the shooter.

Findings

How many mass shootings were known to have been committed using LCMs? We identified 23 total incidents in which more than six people were shot at a single time and place in the United States from 1994 through 2013 and that were known to involve use of any magazines with capacities over 10 rounds. Table 1 summarizes key details of the LCM-involved mass shootings relevant to the issues addressed in this article.

What fraction of all mass shootings are known to involve LCMs? There is no comprehensive listing of all mass shootings available for the entire 1994–2013 period, but the most extensive one currently available is the one at the Shootingtracker.com website, which only began its coverage in 2013. For 2013, this database identified 31 incidents in which more than six victims were supposedly killed or injured. This source includes deaths or injuries of perpetrators in their counts of “victim” deaths and injuries and also counts as victims’ persons who were shot at, but not hit. Correcting these flaws eliminated six of the incidents as mass shootings, while another three incidents were spree shootings. Eliminating these nine ineligible incidents left 22 genuine mass shootings. The Shootingtracker database itself does not record LCM use, but examination of news media accounts indicated that none of these 22 incidents in 2013 were known to involve use of an LCM. For 2013, the Violence Policy Center (2015) identified just one shooting with more than six victims killed or injured that involved an LCM, but this incident was a spree shooting in which eight people were shot in three different widely spaced locations, with no more than three shot in any one of the locations (the June 7, 2013, incident in Santa Monica, CA). Thus, there apparently were zero mass shootings in 2013 known to involve LCMs.

To put these numbers in perspective, for the United States as a whole in 2013, there were an estimated 14,196 people killed in murders and nonnegligent manslaughters (MNNM) involving any weapon types, 9,795 of them killed with firearms (U.S. FBI, 2014b). There were an estimated 13,349 mnnm incidents,¹ of which just 3 involved more than six dead victims, 12,675 involved a single dead victim, and 13,346 involved six or fewer dead victims (U.S. Department of Justice Federal Bureau of Investigation, 2015). The 22 qualifying shooting incidents identified by Shooting Tracker as involving more than six victims therefore accounted for less than one sixth of 1% of homicide incidents and victims killed in those incidents claimed less than one tenth of 1% of homicide victims.

One might speculate that there were significant numbers of mass shootings in which LCMs were used, but not a single news account mentioned the LCM use. The use of LCMs has been a major focus of gun control advocacy groups and national news outlets since at least 1989, when a Stockton California schoolyard shooting lead to the nation’s first state-level assault weapons ban (Kleck, 1997, chap. 4). In this light, it seems unlikely that LCM use in a mass shooting would go completely unreported in all news accounts, but it cannot be ruled out as a logical possibility. It is, however, irrelevant to our analyses unless shootings with unmentioned LCM use are systematically different from those that explicitly mentioned LCM use—a speculation we cannot test.

LCMs are sometimes defined as magazines holding over 10 rounds, sometimes as those holding over 15 rounds (Koper, 2004). For our entire 20-year study period of 1994–2013, 23 mass shootings were known to involve LCMs using the more inclusive cutoff of 10 rounds, that is, at least one round was fired during the incident from a gun equipped with a magazine capable of holding more than 10 rounds. Using the more stringent cutoff of more than 15 rounds, 20 incidents were known to involve LCMs.

Thus, LCM-involved mass shootings are known to have occurred an average of once per year in the United States over this 20-year period.

How often have bystanders intervened while a mass shooter was trying to reload? How many times people have disrupted a mass shooting while the shooter was trying to load a detachable magazine into a semiautomatic gun? Note that it is irrelevant whether interveners have stopped a shooter while trying to reload some other type of gun, using other kinds of magazines, since we are addressing the potential significance of restrictions on the capacity of detachable magazines that are used only with semiautomatic firearms. Thus, bystander intervention directed at shooters using other types of guns that take much longer to reload than a semiautomatic gun using detachable magazines could not provide any guidance as to the likelihood of bystander intervention when the shooter was using a semiautomatic gun equipped with detachable magazines that can be reloaded very quickly. Prospective interveners would presumably be more likely to tackle a shooter who took a long time to reload than one who took only 2- to 4-s to do so. Likewise, bystander interventions that occurred at a time when the shooter was *not* reloading (e.g., when he was struggling with a defective gun or magazine) are irrelevant, since that kind of bystander intervention could occur regardless of what kinds of magazines or firearms the shooter was using. It is the need to reload detachable magazines sooner and more often that differentiates shooters using smaller detachable magazines from those using larger ones.

For the period 1994–2013 inclusive, we identified three mass shooting incidents (with or without LCM use) in which it was claimed that interveners disrupted the shooting by tackling the shooter while he was trying to reload. In only one of the three cases, however, did interveners actually tackle the shooter while he may have been reloading a semiautomatic firearm. In one of the incidents, the weapon in question was a shotgun that had to be reloaded by inserting one shotshell at a time into the weapon (*Knoxville News Sentinel* “Takedown of Alleged Shooter Recounted” July 29, 2008, regarding a shooting in Knoxville, TN on July 27, 2008), and so the incident is irrelevant to the effects of detachable LCMs. In another incident, occurring in Springfield, OR, on May 21, 1998, the shooter, Kip Kinkel, was using a semiautomatic gun, and he was tackled by bystanders, but not while he was reloading. After exhausting the ammunition in one gun, the shooter started firing another loaded gun, one of the three firearms he had with him. The first intervener was shot in the hand in the course of wresting this still-loaded gun away from the shooter (*The (Portland) Oregonian*, May 23, 1998).

The final case occurred in Tucson, AZ, on January 8, 2011. This is the shooting in which a man named Jared Loughner attempted to assassinate Representative Gabrielle Giffords. The shooter was using a semiautomatic firearm and was tackled by bystanders, purportedly while trying to reload a detachable magazine. Even in this case, however, there were important uncertainties. According to one news account, one bystander “grabbed a full magazine” that the shooter dropped, and two others helped subdue him (Associated Press, January 9, 2011). It is not, however, clear whether this bystander intervention was facilitated because (1) the shooter was reloading or

because (2) the shooter stopping firing when his gun or magazine failed to function properly. Eyewitness testimony, including that of the interveners, was inconsistent as to exactly why or how the intervention transpired in the Giffords shooting. One intervener insisted that he was sure the shooter had exhausted the ammunition in the first magazine (and thus was about to reload) because he saw the gun's slide locked back—a condition he believed could only occur with this particular firearm after the last round is fired. In fact, this can also happen when the gun jams, that is, fails to chamber the next round (Morrill, 2014; Salzgeber, 2014).

Complicating matters further, the *New York Times* reported that the spring on the second magazine was broken, presumably rendering it incapable of functioning. Their story's headline and text characterized this mechanical failure as "perhaps the only fortunate event of the day" (*New York Times* "A Single, Terrifying Moment: Shots, Scuffle, Some Luck," January 10, 2011, p. A1). If the *New York Times* account was accurate, the shooter would not have been able to continue shooting with that magazine even if no one had stopped him from loading it into his gun. Detachable magazines of any size can malfunction, which would at least temporarily stop a prospective mass shooter from firing, and thereby provide an opportunity for bystanders to stop the shooter. It is possible that the bystander intervention in the Tucson case could have occurred regardless of what size magazines the shooter possessed, since a shooter struggling with a defective small-capacity magazine would be just as vulnerable to disruption as one struggling with a defective LCM. Thus, it remains unclear whether the shooter was reloading a functioning magazine when the bystanders tackled him.

The real significance of LCM use in the Gabrielle Giffords shooting is that the first magazine that the shooter used had a capacity of 33 rounds, and the shooter fired 31 times before being tackled. Had he possessed only a 15-round magazine, and bystanders were willing to intervene when the shooter either reloaded or struggled with a defective magazine, he would have been able to fire at most 16 rounds (including one in the firing chamber)—15 fewer than the 31 he actually fired before he was stopped, for whatever reason. Consequently, instead of the 19 people he shot (6 fatally, 13 nonfatally), it would be reasonable to estimate that he would have shot only about half as many victims. Thus, the absence of an LCM might have prevented three killings and six or seven nonfatal gunshot woundings in this incident.

The bystander intervention in the Giffords shooting was, however, unique, and occurred only because there were extraordinarily courageous and quick-thinking bystanders willing and able to tackle the shooter. Over a 20-year period in the United States, the Tucson incident appears to be the only known instance of a mass shooter using a semiautomatic firearm and detachable magazines in which the shooter was stopped by bystanders while the shooter may have been trying to reload such a magazine. All other mass shootings have instead stopped only when the shooter chose to stop and leave the scene, the shooter committed suicide, or armed police arrived and forced the shooter to stop (see U.S. FBI, 2014a).

The use of multiple guns and multiple magazines. Restrictions on LCMs obviously could not have affected mass shootings in which no LCMs were used, so it is just those that

Table 2. Summary of Key Characteristics of Mass Shootings (>6 Shot) With Large-Capacity Magazines, United States, 1994–2013.

Key Characteristics of the Incidents	Mass Shootings With Magazines Over 10 Rounds (n = 23)			Mass Shootings With Magazines Over 15 Rounds (n = 20)		
	Yes	No	Not Reported	Yes	No	Not Reported
Multiple guns	17 (74/74%)	6	0	15 (75/75%)	5	0
Multiple magazines	23 (100/100%)	0	0	20 (100/100%)	0	0
Both multiple guns and multiple magazines	17 (74/74%)	6	0	15 (75/75%)	5	0
Either multiple guns or multiple magazines	23 (100/100%)	0	0	20 (100/100%)	0	0
Shooter reloaded	14 (88/61%)	2	7	12 (86/60%)	2	6

Note. First number in parentheses after each frequency is the percentage of incidents with nonmissing information that had the indicated attribute. The second number in parentheses is the percentage of all incidents, including those for which the relevant information was missing, that had the indicated attribute.

involved LCMs that are relevant to judging the benefits that might have accrued had LCMs been unavailable at the beginning of the study period. As previously noted, there is considerable evidence that people who commit large-scale shootings, unlike most ordinary aggressors, devote considerable advance planning to their crimes. Part of their preparations entails cumulating multiple guns, multiple magazines, and many rounds of ammunition. The significance of this is that, in cases where the shooter has more than one loaded gun, he can continue firing, without significant pause, even without LCMs, simply by switching to a loaded gun. Alternatively, if he has multiple small magazines rather than LCMs, the shooter can continue firing many rounds with only a 2- to 4-s pause between shots for switching magazines.

Table 2 displays how often LCM-involved mass shootings involved shooters using either multiple guns or multiple magazines. Of 23 such incidents using the “more-than-10-rounds” criterion, the shooters possessed more than one gun in 17 incidents (74%), leaving six cases in which it was known that the shooter possessed just one gun. Of 20 incidents using the more-than-15-rounds criterion, the shooters possessed more than one gun in 15 incidents (75%), leaving five cases in which it was known that the shooter possessed just one gun.

Of 23 mass shootings with LCMs (>10 rounds), offenders were known to possess multiple detachable magazines in all 23 incidents (100%). Likewise, of the 20 mass shootings with magazines holding over 15 rounds, all 20 involved shooters with multiple magazines.

The average number of magazines in the immediate possession of offenders in incidents in which magazines with a capacity greater than 10 were possessed was at least 5.78 (Table 1). These offenders could have continued firing, even if they had possessed only one gun, with only the interruptions of 2–4 s that it would take for each magazine change.

In sum, there were no mass shootings in the United States in 1994–2013 known to have involved LCMs in which the shooter did not possess either multiple guns or multiple detachable magazines. In all mass shootings in which the shooters were known to have possessed one or more LCMs, the shooters could have either continued firing many rounds without any interruption at all simply by switching loaded guns or could have fired many rounds with only very brief interruptions of 2–4 s to change detachable magazines.

The offenders in LCM-involved mass shootings were also known to have *reloaded* during 14 of the 23 (61%) incidents with magazine holding over 10 rounds. The shooters were known to have *not* reloaded in another 2 of these 20 incidents, and it could not be determined if they reloaded in the remaining seven incidents. Thus, even if the shooters had been denied LCMs, we know that most of them definitely would have been able to reload smaller detachable magazines without interference from bystanders since they in fact did change magazines. The fact that this percentage is less than 100% should not, however, be interpreted to mean that the shooters were *unable* to reload in the other nine incidents. It is possible that the shooters could also have reloaded in many of these nine shootings, but chose not to do so, or did not need to do so in order to fire all the rounds they wanted to fire. This is consistent with the fact that there has been at most only one mass shooting in 20 years in which reloading a semiautomatic firearm might have been blocked by bystanders intervening and thereby stopping the shooter from doing all the shooting he wanted to do. All we know is that in two incidents, the shooter did not reload, and news accounts of seven other incidents did not mention whether the offender reloaded.

Do more magazine changes allow more prospective victims to escape? An alternative rationale for why limiting aggressors to smaller magazines would result in fewer casualties in mass shootings is that the increased number of magazine changes necessitated by use of smaller magazines would create additional pauses in the shooting, allowing more potential victims to escape than would otherwise escape. For example, a story in the *Hartford Courant* about the Sandy Hook elementary school killings in 2012 was headlined “Shooter Paused, and Six Escaped,” the text asserting that as many as six children may have survived because the shooter paused to reload (December 23, 2012). The author of the story, however, went on to concede that this was just a speculation by an unnamed source, and that it was also possible that some children simply escaped when the killer was shooting other children. There was no reliable evidence that the pauses were due to the shooter reloading, rather than his guns jamming or the shooter simply choosing to pause his shooting while his gun was still loaded.

The plausibility of the “victims escape” rationale depends on the average rates of fire that shooters in mass shootings typically maintain. If they fire very fast, the 2–4 s it takes to change box-type detachable magazines could produce a slowing of the rate of fire that the shooters otherwise would have maintained without the magazine changes, increasing the average time between rounds fired and potentially allowing more victims to escape during the between-shot intervals. On the other hand, if mass

Table 3. Known Rates of Fire in Mass Shootings, 1994–2013.

Date of Incident	Shots Fired ^a	Time of Firing (Minutes) ^a	Average Shots Per Minute	Average Seconds Per Shot	Number of Guns
June 20, 1994	>50	c. 5	>10	<6.0	2
February 28, 1997	1,101	44	25	2.4	4
April 20, 1999	188	49	3.8	15.8	4
September 15, 1999	>100	10	>10.0	<6.0	2
September 2, 1999	10	<30	>0.33	<180.0	1
May 24, 2000	c. 7	<90	>0.08	<771.4	1
September 22, 2000	9+	<10	>0.9	<66.7	1
December 26, 2000	37	5–8 (6.5)	5.7	10.5	3
February 5, 2001	25–30 (27.5)	8–15 (11.5)	2.4	25.1	4
March 5, 2001	c. 24	6	c. 4.0	c. 15.0	1
March 12, 2005	22	<1	>22.0	<2.7	1
March 21, 2005	45	9	5.0	12.0	3
March 25, 2006	9+	c. 5	>1.6	<33.3	2
October 2, 2006	17–18 (17.5)	c. 2	c. 8.75	c. 6.9	2
April 16, 2007	c. 174	156	c. 1.11	c. 53.8	2
October 7, 2007	30	c. 1	c. 30.0	c. 2.0	3
December 5, 2007	>30	c. 6	>5.0	<12.0	1
February 14, 2008	56	5	11.1	5.4	4
January 7, 2010	115	30	3.8	15.7	4
August 3, 2010	19	3	6.3	9.5	2
January 8, 2011	31	0.25	125	0.48	1
September 6, 2011	60+	1.42	42.3+	1.4	3
July 20, 2012	76	c. 6	12.7	4.74	4
September 27, 2012	46+	14	>3.3	<18.3	1
December 14, 2012	154+	4	38.5+	1.6	3

Note. c = circa.

^aWhere a range was provided in news accounts, the midpoint of the range (shown in parentheses) of shots fired or time of firing was used in rate-of-fire computations.

shooters fire their guns with the average interval between shots lasting *more* than 2–4 s, the pauses due to additional magazine changes would be no longer than the pauses the shooter typically took between shots even when not reloading. In that case, there would be no more opportunity for potential victims to escape than there would have been without the additional magazine changes.

Table 3 displays data on rates of fire for LCM-involved mass shootings in 1994–2013. Information on both the duration of the firing and the number of rounds fired was available for 17 of the 23 incidents shown in Table 1 plus another 8 mass shootings for which the necessary information was available but that did not involve any known LCM use. Reliable information on duration of fire may well be unavailable from any source for many mass shootings. There are rarely audio recordings that would provide precise information on the duration of fire (as there were in the 2012 Aurora Colorado movie

theater shooting), so eyewitness estimates are usually the basis for establishing this. On the other hand, there is often quite reliable information on the number of rounds fired, since semiautomatic firearms eject an empty shell casing after each round is fired. When shooters use such guns, crime scene investigators can (absent removal of the evidence by the offender or souvenir hunters) establish the number of rounds fired by counting cartridge casings recovered at the scene.

Average rate of fire was computed as the average number of seconds between shots. In the 25 incidents for which average rates of fire could be determined, shooters never maintained an average rate of fire anywhere as fast as that at which their firearms were capable of firing. Shooters firing as fast as the gun allows can easily fire three rounds per second with a typical semiautomatic firearm, that is, with only about one third of a second between rounds. In only three incidents were mass shooters known to have averaged less than 2 s between rounds. This is no more than one sixth of the maximum rate of fire of which semiautomatic guns are capable (see Table 3, incidents occurring on January 8, 2011, September 6, 2011, and December 14, 2012). This means that taking 2 s to reload a detachable magazine would not have slowed the shooters' average rate of fire at all in 22 of the 25 incidents for which rate of fire could be established and would have only slightly slowed the rate in the remaining three incidents.

It cannot be assumed, however, that in the three incidents in which usually high rates of fire were maintained, use of smaller magazines would have slowed the rate of fire due to a need to change magazines more often. Shooters possessed multiple guns in two of these three relatively rapid fire incidents (those occurring on September 6, 2011 and December 13, 2012), which means that, rather than needing to change magazines to continue shooting, the aggressors could simply have switched guns, from one firearm emptied of rounds to another loaded firearm, without pausing in their shooting at all. Over the 20-year study period, there was just one LCM-involved mass shooting incident in the United States in which a shooter maintained an average rate of fire with less than 2 s elapsing between shots, *and* possessed only a single gun—the shooting involving Jared Loughner (on January 8, 2011), who was stopped from further shooting when he was tackled by bystanders.

In sum, in nearly all LCM-involved mass shootings, the time it takes to reload a detachable magazine is no greater than the average time between shots that the shooter takes anyway when not reloading. Consequently, there is no affirmative evidence that reloading detachable magazines slows mass shooters' rates of fire, and thus no affirmative evidence that the number of victims who could escape the killers due to additional pauses in the shooting is increased by the shooter's need to change magazines.

Conclusions

In light of the foregoing information, it is unlikely that the larger number of rounds fired in the average LCM-linked mass shooting found by Koper (2004) was in any sense caused by the use of LCMs. In all but one of such cases in the period from 1994 through 2013, there was nothing impossible or even difficult about the shooter firing

equally large numbers of rounds even if he had possessed only smaller capacity magazines, since the same number of rounds could easily have been fired with smaller detachable magazines of the sort that would remain legally available under LCM bans. Instead, the larger number of rounds fired by LCM-using shooters is more likely to reflect the more lethal intentions prevailing among such shooters, just as their planned use of multiple guns and multiple magazines, and the unusually high fatality rate (deaths over total woundings) of their attacks are outward indications of a desire to shoot many people. Unfortunately, there are no known methods for reliably measuring the lethality of shooters' intentions independent of the outcomes of their crimes, making it impossible to statistically control for this factor in a multivariate statistical analysis and thereby isolate the effects of LCM use.

One cannot prove a negative, and it is possible that mass shooters in the future might be different from those in the past, and that would-be mass shooters, unlike those of the past, would not obtain multiple guns or multiple smaller capacity magazines as substitutes for LCMs. One might also speculate that incidents that did *not* end up with many shooting victims turned out that way because the shooter did *not* use an LCM. At this point, however, there is little sound affirmative empirical basis for expecting that fewer people would be killed or injured if LCM bans were enacted.

Focusing gun control efforts on mass shootings makes sense from a political standpoint, since support for gun control is elevated following highly publicized gun crimes. Such efforts, however, are less sensible for purposes of reducing the death toll from gun violence, especially if they focus on technologies rarely used in gun crime as a whole. Controls aimed at reducing ordinary forms of firearm violence, such as shootings with just one or a few victims, are more likely to have large impacts on the aggregate gun violence death toll for the simple reason that nearly all victims of gun violence are hurt in incidents with a small number of victims. For example, less than 1% of U.S. homicide incidents in 2013 involved more than two victims killed (U.S. Department of Justice Federal Bureau of Investigation, 2015).

Most types of gun control focus on preventing more dangerous people from acquiring, possessing, or using *any* type of gun, and therefore have potential to prevent a wide array of gun crimes. A prime example is a law requiring background checks on persons seeking to buy guns. Gun laws with a background check component, such owner license and purchase permit laws, have been found to be potentially effective in reducing homicide (Kleck & Patterson, 1993, p. 274). There is already a federal law requiring background checks, but it only applies to purchases from licensed gun dealers. Extending these checks to cover private gun transfers—that is, implementing a federal universal background check (Kleck, 1991, pp. 433–435)—is far more likely to prevent significant numbers of gun crimes than measures aimed at rarely used gun technologies like LCMs and extremely rare types of violent incidents like mass shootings.

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Supplementary Material

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Note

1. Supplementary Homicide Reports (SHR) data for 2013 indicate that there were an average of 1.063 victims per SHR-covered homicide incident, implying 13,349 incidents.

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